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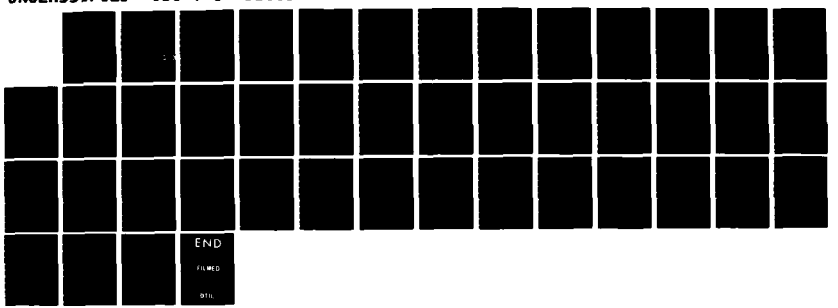

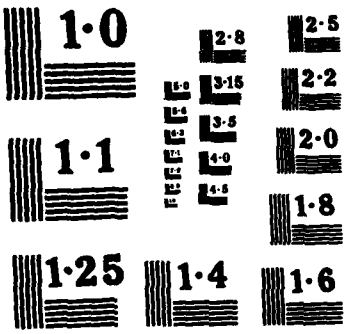

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VALIDATION OF THE DATA SOURCES AND PROCESSES OF THE VAMOSC II COMPONENT SUPPORT COST SYSTEM (D160B)

FINAL REPORT

Contract No. F33600-82-C-0543

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Report Number
V-84-31859-21

Submitted to:

HEADQUARTERS
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1.0 INTRODUCTION

Visibility and Management of Operating and Support Costs (VAMOSC) is a program initiated by the Office of the Secretary of Defense (OSD) in order to ensure that each Military Department gathers, tracks, and computes operating and support costs by weapon system. VAMOSC II is an Air Force management information system which is responsive to the OSD initiative. It uses information from existing Air Force systems to satisfy both Air Force and OSD needs for certain weapon system operating and support (O&S) costs.

At present, the VAMOSC II system comprises three subsystems:

(1) The Weapon System Support Cost (WSSC) system (D160), which deals with aircraft,

(2) The Communications - Electronics (C-E) system (D160A), which deals with ground communications - electronics equipment,

(3) The Component Support Cost Subsystem (CSCS) (D160B), which deals with subsystems and components for aircraft.

The Component Support Cost System (CSCS) of VAMOSC II gathers and computes support costs by assembly/subassembly and relates those costs back to the end item or weapon system. CSCS replaces the Logistic Support Cost (LSC) model of K051 (AFLCR 400-49) for aircraft and engines.

The objectives of the Component Support Cost System are:

(1) To improve the visibility of aircraft and engine component support costs and to relate those costs to the end item or weapon system.

(2) To improve the Life Cycle Costing capability for the Air Force and the Department of Defense in the acquisition of new weapon systems.

(3) To assist in the design of new weapon systems by providing cost information on existing weapon systems, thereby enhancing design tradeoff studies.

(4) To provide historical cost information at the weapon system level to improve logistic policy decisions.

(5) To identify system component reliability, effectiveness, and costs so that high support cost items may be identified and addressed.

The CSCS receives inputs from 15 Air Force data systems. On a quarterly basis, the system provides two standard reports each processing cycle and twelve other types of reports as requested by users. It also provides pre-programmed data base extracts on magnetic tape on a one-time basis in response to user requests. Special requests for data in user selected format may also be satisfied on a case by case basis.

At the heart of the CSCS is a set of 30 algorithms for estimation or allocation of costs. Table 1 identifies the algorithms by name. Information Spectrum, Inc. (ISI) was awarded a contract to validate these algorithms. This effort included investigations of logic, appropriateness of the algorithms, and assumptions inherent in the algorithms. ISI was also to survey published findings, reports of audit, etc. relating to the accuracy of the source data systems.

The analyses of the CSCS algorithms were called "general tasks"

TABLE 1. CSCS ALGORITHM NAMES

1. Base TCTO Labor Cost
2. Base TCTO Overhead Cost
3. Base TCTO Material Cost
4. TCTO Transportation Costs
5. Base Inspection Costs
6. Base Other Support General Costs
7. Base Labor Costs
8. Base Direct Material Costs
9. Base Maintenance Overhead Costs
10. Second Destination Transportation Costs
11. Second Destination Transportation Costs (Engine)
12. Base Exchangeable Repair Costs (NSN)
13. Base Exchangeable Repair Costs (Engine)
14. Base Exchangeable Modification Costs (NSN)
15. Base Condemnation Spares Costs/NSN
16. Base Exchangeable Modification Costs (Engine)
17. Base Supply Management Overhead Costs
18. Depot TCTO Labor Costs
19. Depot TCTO Material Costs
20. Depot TCTO Other Costs
21. Depot Support General Costs
22. Depot Labor Costs
23. Depot Direct Material Costs
24. Depot Other Costs
25. Depot Exchangeable Repair Costs (NSN)
26. Depot Exchangeable Repair Costs (Engine)
27. Depot Exchangeable Modification Costs (NSN)
28. Depot Exchangeable Modification Costs (Engine)
29. Depot Condemnation Spares Costs (NSN)
30. Depot Material Management Overhead Cost

by the contract. In addition, two "specific tasks" were assigned. One of these tasks concerned the "NSN/WUC Cross Reference Dictionary." Base maintenance costs and the bulk of CSCS outputs are expressed in terms of Work Unit Codes (WUCs). Base and depot supply information and depot maintenance costs are collected in terms of item National Stock Numbers (NSNs). One of the more critical parts of the CSCS logic was the development and maintenance of a NSN/WUC Cross Reference Dictionary. ISI's first specific task was to devise a suitable methodology to verify accuracy of the dictionary, as well as techniques to insure continued accuracy.

One of the CSCS algorithms allocates base supply management overhead costs to the individual WUCs. The Office of VAMOSC (OOV) questioned the accuracy of the methodology used in this algorithm. ISI's second specific task was to develop a new method for allocating base supply management overhead costs to WUCs on a quarterly basis.

In its response to the government's solicitation[1], Information Spectrum proposed also to investigate the usefulness of CSCS output reports to the user community. Moreover, in the earliest stages of the effort ISI recognized the desirability of generating a final report. It summarizes the activities of the project. It compiles the recommendations which arose out of the analyses of the individual algorithms. Compilation is appropriate because some recommendations are common to several algorithms.

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[1] Solicitation number F33600-82-R-0307

This report also provides a vehicle for presentation of an analysis of the survey of CSCS users. Finally, the project engendered several recommendations which relate to the Component Support Cost System as a whole, rather than to any particular algorithm. It was not appropriate to include these recommendations in any of the reports which addressed the individual algorithms; they are provided here.

2.0 SUMMARY OF PROJECT ACTIVITIES

Information Spectrum, Inc. began work on this project in mid August, 1982, and completed it in August, 1984. During this period development, modification, and validation of the CSCS programs went on. At any stage of its effort, ISI accepted current descriptions of the program functions as definitive.

The largest part of the activity was devoted to validation of the 30 CSCS cost algorithms. That effort is described in section 2.1 of this report. The "specific task" dealing with the NSN/WUC Cross Reference Dictionary was also a significant effort. The activities are described in section 2.2. The other "specific task," development of a new methodology for dealing with base supply management overhead cost, was incorporated into the analysis of the existing algorithm addressing that cost.

The survey of CSCS users took place toward the end of the project. Section 2.3 summarizes this activity.

2.1 Algorithm Analyses

Early activities included development of an algorithm analysis methodology and a report format applicable to analysis of all algorithms.

The CSCS uses input data from 15 other Air Force data systems. It reflects maintenance and supply procedures at both base and depot levels. It is strongly influenced by Department of Defense cost analysis policy and guidance. For all these reasons, it was appropriate to collect and review a large number of reference documents. By the end of the project more than 120 regulations, manuals,

reports, etc. had been catalogued. Many of these provided significant contributions to the algorithm analysis process.

In some cases the CSCS algorithms were sufficiently similar to each other so that it was appropriate to discuss two or more algorithms in a single report. In total, the analyses of the 30 algorithms resulted in 19 reports, which are identified in Table 2.

These reports have been provided separately to the Office of VAMOSC. The OOV desired that each report stand alone — that is, be complete without the need for reference to another report. Accordingly, some material on the background of the CSCS and on the general methodology is repeated in all of the reports. Also, it proved convenient to provide a single list of references common to all reports, although any single report uses only a portion of the references.

The solicitation identified aspects of the algorithms to be considered. These aspects concerned accuracy, assumptions, directness of costing, etc. For each algorithm, each of these aspects was considered. Each was either affirmed or rejected by ISI. Whenever some aspect of an algorithm was rejected, ISI provided a suitable recommendation. Drafts of the analyses, including these recommendations, were provided to the Office of VAMOSC. The OOV provided a written response to each recommendation. In general, these replies identify the actions which the OOV plans to take in response to the recommendations. They are incorporated into the algorithm analysis reports. ISI's recommendations regarding the CSCS cost algorithms are compiled in Appendix A of this report, and summarized in Section 3.1.1.

Table 2. CSCS Algorithm Analysis Reports

No.[1]	Subject[2]	Algorithms Addressed[3]
01	Base TCTO Labor Costs	1
02	Base TCTO Overhead Costs	2
03	Base TCTO Material Costs	3
04	Base Inspection Costs	5
05	Base Other Support General Costs	6
06	Base Labor Costs	7
07	Base Direct Material Costs	8
08	Base Maintenance Overhead Costs	9
09	Base Exchangeable Repair Costs (NSN) and Base Exchangeable Modification Costs (NSN)	12,14
10	Base Exchangeable Repair Costs (Engine) and Base Exchangeable Modification Costs (Engine)	13,16
11	Base and Depot Condemnation Spares Costs (NSN)	15,29
12	Depot TCTO Labor Costs	18
13	Depot TCTO Material Costs	19
14	Depot TCTO Other Costs	20
15	Depot Support General, Labor, Direct Material, and Other Costs	21,22,23,24
16	Depot Exchangeable Repair and Modification Costs for NSNs and Engines	25,26,27,28
17	Base Supply Management Overhead Costs	17
18	Depot Material Management Overhead Costs	30
19	Second Destination Transportation Costs	4,10,11

(1) Information Spectrum report numbers for this series are of the form V-83-31859-nn, where nn is the number in this column.

(2) Each CSCS algorithm analysis report title is of the form "Validation of the Algorithm for (Subject) for the Component Support Cost System (D160B)."

(3) As numbered in Table 1.

2.2 NSN/WUC Cross Reference Dictionary Activities

The consideration of the NSN/WUC Cross Reference Dictionary involved analysis of complex paths of logic and procedure. A variety of references were consulted; eleven are cited in the report. Frequent contact with Air Force personnel in person and by telephone led to an understanding of the established procedures for generating the dictionary, updating it, and using it. Careful consideration of the information led to questions, which were resolved by further oral, and sometimes written, contacts.

As a detailed understanding of the dictionary developed, the analyst focused his attention on possible sources of inaccuracy in its development, maintenance, and application. Development of appropriate recommendations was a creative process which was reinforced through further discussion with cognizant Air Force personnel. The results were assembled into a report which was presented in draft form to the Office of VAMOSC for their critique. After ISI resolved any uncertainties thus revealed, a final version was issued.

2.3 Base Supply Management Overhead Costs

Analysis and critique of the algorithm currently in the CSCS for allocating base supply management overhead costs was a natural part of the "general task" required by the solicitation. ISI, like the Office of VAMOSC, considered this existing algorithm unsatisfactory. Accordingly, recommendation of an improvement was also called for by the general task, and was achieved just as were other recommendations. Thus, although the development of a modified method for

allocating base supply management overhead costs was identified as a specific task, the activities were part of those used for the algorithm analysis performed as a general task.

2.4 User Survey

As mentioned earlier, the CSCS continued to evolve throughout the period of this effort. Accordingly, the user survey was delayed as long as possible. ISI developed a questionnaire, which is reproduced here as Figure 1. That questionnaire was distributed by the OOV on March 20, 1984 to 141 addressees in 106 organizations. The addressees comprised all (56) continuing recipients of CSCS reports, all who have ever received a one-time report, and all on the mailing list for the annual tri-service VAMOSC conferences.

Thirty-three replies were received by the OOV, and copies were provided to ISI. These were analyzed as part of the preparation of this final report, and as described in Appendix B. Responses were tabulated and subjected to qualitative analysis. The results of this tabulation and analysis also appear in Appendix B.

PLEASE COMPLETE THIS QUESTIONNAIRE
FOLD, STAPLE AND MAIL TO THE ADDRESS
ON THE REVERSE BY 1 MAY 1984

1. Are you familiar with the CSCS Users Manual. Circle one (Y) (N)

   a. If yes, does it provide an adequate description of the CSCS data available? Circle one (Y) (N)

2. If not familiar with CSCS data products, what needs do you have for historical operating and support (O&S) costs at the aircraft component (WUC) level? _____

   _____

3. List reports/data you currently receive from the CSCS. Identify data elements that are of particular interest to you by their titles on the report. _____

   _____

   _____

4. Do the reports you currently receive provide all the information you require? Circle one. (Y) (N)

5. Indicate information you would like to see from CSCS that is <u>not included</u> in current reports. _____

   _____

6. Do you consider the CSCS data to be useful? Circle one. (Y) (N)

7. Is the format of the current output reports satisfactory. Circle one. (Y) (N)

   a. Is the media of the current output reports (microfiche, tape) satisfactory? Circle one. (Y) (N)

8. How in your opinion can the CSCS output reports be improved? _____

   _____

9. Do you have a continuing/regular need for CSCS data. Circle one. (Y) (N)

10. Is the meaning of the information on CSCS reports clear and understood? Circle one. (Y) (N)

    a. Explain if NO. _____

    _____

Figure 1. <u>CSCS User Survey</u>

11. In your opinion, would a training package in the derivation/definition of CSCS data be useful? Circle one (Y) (N)

12. Are the CSCS quarterly output reports timely enough for your purposes? Circle one. (Y) (N)

13. Indicate the functional areas in which you have an interest in aircraft component costs.

( ) Logistics ( ) Cost Estimating

( ) Budget Preparation ( ) Procurement (Acquisition)

( ) Planning and Programming ( ) Other (Specify)

14. What do you/have you used(d) the CSCS data for? _____

_____

15. Provide other comments as desired. _____

_____

_____

(PLEASE PROVIDE RETURN ADDRESS ON REVERSE)

Figure 1. (Continued)

3.0 RESULTS

The study led to many recommendations, which are discussed in Section 3.1. The validation of the accuracy of source data is an area of special interest, and is addressed in Section 3.2. Results of the user survey are reviewed in Section 3.3.

Each CSCS output report contains cost information generated by several algorithms. Section 3.4 considers the accuracy of the reports.

3.1 Recommendations

Section 3.1.1 discusses recommendations arising out of the algorithm analysis. Section 3.1.2 addresses those which resulted from the investigation of the NSN/WUC Cross Reference Dictionary.

3.1.1 Algorithms

In many cases, several CSCS cost algorithms share common techniques. Therefore, a recommendation may apply to several algorithms, and may be presented in more than one of the reports of Table 1. As mentioned in Section 2.1 of this report, repetition occurs because each of the algorithm analysis reports was to be independent of the others.

For this Final Report, a single consolidated list of recommendations was prepared. It is presented in Appendix A, and it provides 18 recommendations. In each case, the problem leading to the recommendation is summarized first, under the heading "Criticism." Then the recommendation is listed.

The Office of VAMOSC, in order to assure the effectiveness and usefulness of this effort, provided a written response to each recommendation. In almost every case, these responses identified the action which would be taken. Those responses are included in the individual algorithm analysis reports, and are summarized under the headings "Response" in Appendix A.

The criticisms, recommendations, and responses presented in Appendix A are digests. For a full understanding of the criticisms and recommendations, and the full text of the OOV responses, it is imperative that the algorithm analysis reports be consulted.

Section 2.1 mentioned that each aspect (as identified by the solicitation) of each algorithm was either affirmed or rejected by ISI. Each recommendation corresponds to a rejection of some aspect (sometimes more than one) of an algorithm. As mentioned, some recommendations apply to several algorithms. Six of the 30 algorithms were fully affirmed, with retention in their present form recommended. These are the algorithms called Base TCTO Material Costs, Base Direct Material Costs, Depot TCTO Labor Costs, Depot TCTO Material Costs, Depot TCTO Other Costs, and Depot Material Management Overhead Costs.

3.1.2 Cross-Reference Dictionary

As indicated in Section 2.2, the study of the NSN/WUC Cross-Reference dictionary required analysis of complex paths of logic and procedure. The constructive result of this effort was a list of recommendations oriented toward correction or avoidance of inaccuracies in the development, maintenance, and application of the Dictionary. The analysis and recommendations are presented

in ISI Report No. V-84-31859-20, "An Investigative Analysis of the NSN-WUC Cross-Reference Dictionary for the Component Support Cost System (D160B)," 21 September 1984. Section 8 of that report lists 30 recommendations. Even for the most knowledgeable reader, it would be necessary to study the report carefully in order to understand the import of the recommendations.

The recommendations are organized by areas of analysis. The first area, "File Integrity," is concerned with the validity and accuracy of the Dictionary. The report provides 11 recommendations. "Workload Management" is concerned with efficient procedures for Dictionary maintenance; 7 recommendations are presented. The relationships among Work Unit Codes and stock numbered items, especially in view of interchangeability and substitutability, include subtle problems. These are addressed by 7 recommendations titled "Cost Output Usability." The complex relationships among Dictionary elements suggest some modernization in the approach to file structure. Three recommendations are provided under the heading "Data Base Organization." Finally, two recommendations address the special problems associated with their title, "Introduction of a New MDS."

3.2 Input Data System Accuracy

As part of its algorithm analysis, ISI was required to validate the accuracy of source data systems providing inputs to the CSCS. This task was to include survey of published findings, reports of audit, etc. Sampling of data was not to be performed. This topic is given special attention in this report because of widespread

interest in a report known in Air Force logistic circles as "the GAO report."[1] This report assails the data in the Maintenance Data Collection System (MDCS) for inaccuracy and lack of timeliness. The GAO report often relies on small samples, and it is more anecdotal than scientific. Nevertheless, as a whole it is convincing.

Information Spectrum also identified a study whose results are incorporated (but not explicitly identified) in the GAO report. Although that study could not be freely extrapolated to all maintenance events, it strongly suggested that many maintenance events are not reported through the MDCS, while man-hours are exaggerated for those that are reported.

The Air Force is testing an automated system which holds promise of considerably improving the accuracy of reporting of maintenance manhours. This system, called the Core Automated Maintenance System (CAMS), provides for real time, automated input, editing, and retrieval of data of the MDCS. The CAMS is currently being tested at Langley AFB. The GAO report does not provide direct evidence of improved accuracy provided by the CAMS, but it cites impressive improvements in the number of maintenance actions reported as completed. It also indicates that Air Force officials believe that the CAMS virtually eliminates inaccuracy in MDC data.

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(1) Report by the Comptroller General of the United States of the Chairman, Committee on Government Operations, House of Representatives, "The Air Force Can Improve Its Maintenance Information Systems," GAO Report No. GGD-83-20, January 25, 1983.

ISI could find no alternative to using MDCS data in the immediate future, despite any accuracies which it may introduce into base labor cost estimates. The CAMS, when introduced, should provide considerable improvement. No change in format of data provided to the CSCS is expected, so no changes to that system will be needed.

For all of the other data systems which provide input to the CSCS, no published criticisms were found.

3.3 User Survey

The results of the user survey are incorporated in this report as Appendix B. Recommendations included there are summarized as follows:

- Survey CSCS users periodically. Review responses, contact responders to clarify their answers, and establish procedures for reacting to responses.
- Study the individual responses to those questions of the questionnaire which called for user comments.
- Develop a training package about the derivation and definition of CSCS data.

3.4 CSCS Output Report Accuracy

Each of the individual algorithm analysis reports noted that the total accuracy of the CSCS output reports could not be considered until all algorithms were reviewed. Accordingly this accuracy is addressed here.

ISI considered extracting from each report a list of output data elements, and on the basis of the algorithm analysis reports branding each element as accurate or inaccurate. A first attempt convinced us that this approach would not provide satisfactory insight. The following list of findings relevant to output report accuracy is appropriate.

(1) There were 30 cost algorithms considered. ISI recommended changes in 24, and no change in the other 6.

(2) Most of the changes should provide only small improvements in the accuracy of calculated costs. For example, one change of wide applicability is the institution of a procedure for recalculating base maintenance labor rates, rather than inflating the rates established in 1980. Another is the use of annual, rather than quarterly, averages of various kinds of depot activity rates.

(3) Many of the cost elements appearing on output reports include the effects of several algorithms. For example, total base and depot Work Unit Code costs include the effects of all of the algorithms. Again, the Logistic Support Cost Ranking report implicitly includes the effect of all of the algorithms in the ranking.

(4) The meanings of some of the cost elements on the reports are not clear from their titles or from any available documentation. OOV personnel have expressed a need to have programming personnel provide precise definitions.

(5) The reports include some numeric items which are not costs. For instance, some display owned inventory, flight hours,

sorties, etc. Consideration of these was outside the scope of this effort.

(6) In the course of this effort, it became evident that any inaccuracies in the output of the algorithms were being obscured by data processing problems. Investigation of these was outside the scope of this effort. Problems may have been due to bad input data or to programming errors. Problems noted included the following:

(a) Large quantities of data are being reported against Work Unit Codes or stock numbers which could not be adequately identified. This could be due to input equipment identification errors or to the incomplete state of the Cross-Reference Dictionary.

(b) Many output quantities are incorrectly displayed as zeros. Note that missing data should not be reported as zero.

(c) Some outputs are not credible. For instance, the latest CSCS output shows base maintenance overhead rates for the F-16A from $0.94 (Kadena) to $76.78 (Zaragoza). Such a range is prima facie not credible.

In summary, ISI believes that the majority of the cost data on CSCS output reports would have some deficiencies based on our criticisms, if they accurately reflected the current design of the algorithms. However, these deficiencies are currently obscured by other data processing problems. Information Spectrum recommends

that the Office of VAMOSC support a validation effort which would trace numerical data through the CSCS, validating intermediate results. Such an effort should locate and correct errors, and provide clarified program documentation. It would result in a thorough internal program validation.

APPENDIX A

COMPILATION OF CRITICISMS, RECOMMENDATIONS, AND RESPONSES FOR CSCS COST ALGORITHMS

Many of the CSCS cost algorithms share common elements. For instance, the algorithms titled Base TCTO Labor Cost, Base Inspection Costs, Base Other Support General Costs, and Base Labor Cost all use the same average base labor rates. Therefore, the reports which address the algorithms sometimes contain identical recommendations.

This appendix compiles the recommendations of the analysis reports.[1] For each topic, the appendix identifies the criticism, the recommendation, and the Office of VAMOSC (OOV) response. None of these is addressed in full detail in this appendix. For a full understanding of the criticisms and recommendations, and the full text of the OOV responses, it is imperative that the algorithm analysis reports be consulted. These reports are identified in Table 1 of the body of this report.

1. Base Direct Labor Rates

Criticism: Several algorithms use the average military base level direct labor rate for each MDS. These rates were calculated based on a 1980 sample, and are being inflated for later years. This will lose validity as time elapses. Moreover, this single military rate is applied to both military and civilian man-hours.

Recommendation: Report No. 06[2] recommends an automated methodology

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[1] It does not include the recommendations for the Cross-Reference Dictionary. See Section 3.1.2.

[2] See Table 1.

to calculate both military and civilian base level direct labor rates for each MDS every quarter. The procedure is similar to that which was used for the 1980 data. No escalation for inflation is needed.

Response: The OOV concurs. It will review the proposal prior to FY 86, when changes to the Maintenance Data Collection System are expected to become possible. In the interim, the OOV will use rates calculated manually, based on reports from the Maintenance Cost System, representing a weighted mix of military and civilian hours.

2. Military and Civilian Labor at Base Level

Criticism: At present, military and civilian base level maintenance man-hours are added, and multiplied by a military direct labor rate. This is inaccurate.

Recommendation: ISI recommends that military and civilian man-hours be provided to the CSCS separately. These should have separate labor rates applied. Civilian and military labor costs should be displayed separately.

Response: OOV found from a sample that only two to three percent of the total base maintenance work force are civilians. Therefore, the utility of separate costing of military and civilian labor is questionable. (The use of a weighted composite rate instead of a pure military rate, identified in the response to item 1 above, provides a simpler, if less precise, solution.)

OOV will further review this proposal. They question the utility of displaying civilian and military labor costs separately on output reports.

3. Inflation Factors

Criticism: In escalating labor rates, the CSCS uses annual inflation indexes published by the Department of Defense. The quarterly CSCS reports will be based on labor rates showing no change for three quarters, and a full year's worth of change the fourth. This needlessly introduces irregularity into calculated labor costs. (However, it now appears that the OOV will calculate new labor rates as pay rates change, which will solve the problem.)

Recommendation: ISI recommends simple linear interpolation formulas which provide for applying an appropriate portion of inflation each quarter.

Response: The OOV concurs.

4. System Documentation

Criticism: Three documents were primary references in ISI's analyses. They are known as the User's Manual, the Functional Description, and the System Specification. These documents are also primary vehicles for communication within the OOV. They were found to be significantly deficient in accuracy, clarity, completeness, and consistency. We believe that this will hamper future development of the CSCS.

Recommendation: ISI recommends that the three documents be revised.[1] We recommend a significant allocation of attention, time, and resources.

Response: The OOV indicates that revisions and updates are in process for all documents. Until an acceptable level of consistency is obtained and a system to maintain that level is implemented, this will remain a major work effort. The OOV expected to be in a satisfactory posture regarding this area by 1 July 1984.

5. Input Data System Error

Criticism: As a result of ISI investigations, personnel of the Air Force System Design Center determined that the D002A system is incorrectly counting local manufacture receipts as issues in information provided to the CSCS.

Recommendations: Information Spectrum recommends that the error be corrected.

Response: The OOV concurs.

6. Labor Rates for Overhead Costs

Criticism: As a part of the calculation of base maintenance overhead cost, the CSCS calculates base maintenance direct labor cost by multiplying man-hours by a single, Air Force-wide, direct labor rate. This procedure sacrifices some accuracy which is available.

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[1] A first revision to the System Specification was received after this recommendation was made. We feel that further revision is still needed.

For the bulk of base maintenance labor, the man-hours identified with each MDS could be multiplied by the labor rate applicable to that MDS.

Recommendation: It is recommended that the procedure for developing the Base Overhead Cost Rate be refined by multiplying the DLR for each MDS times the direct labor hours that can be identified to that MDS. The worldwide single DLR would be applied only to all those base direct labor hours that cannot be identified to an MDS, such as labor hours for GSE. These costs would be added to produce a more accurate Base Direct Labor Cost.

Response: The OOV concurs. A suspense date for DAR submission is 31 January 1984, and projected implementation is FY 87.

7. Depot Activity Rates

Criticism: Of the exchangeable items turned in to a depot, some are eventually repaired, some are modified, and some are condemned. Several algorithms involve estimates of these proportions. The estimates for each WUC are based on the experience or the most recent quarter.

It is common practice to accumulate items at a depot for many months, and then to process them. As a result, estimates of proportions based on one quarter of data are not expected to be representative.

Recommendation: ISI recommends that estimates of depot activity rates be based on the most recent four quarters of data. Moreover,

if no items of a particular WUC have been worked on for the latest four quarters, the previous estimates of depot activity rates should be retained.

Response: The OOV concurs. The suspense date for a DAR requesting this change is 31 May 1984.

8. Depot Cost Extrapolation

Criticism: The current method used to compute average depot repair and modification costs relies on the assumption that both repair and modification take place for every NSN in every quarter. In the event that no such activity takes place for a particular NSN in a particular quarter, the program incorrectly uses zero.

Recommendation: ISI recommends that when no depot repair or modification takes place for a particular NSN in a particular quarter, the CSCS should estimate the average cost by using the figure from the previous quarter, adjusted for inflation.

Response: The OOV concurs. The suspense date for a DAR requesting this change is 31 May 1984.

9. Depot MDS Labor Rates

Criticism: Several algorithms estimate depot labor costs by multiplying depot labor hours for a particular kind of work (Support General, on-equipment repair, or non-modification TCTO) by an average depot labor rate. This labor rate is the result of dividing total depot labor costs for these kinds of work by the corresponding total depot labor man-hours. However, the man-hours

used for this rate are extracted from a different data system (H036B) than is used for the man-hours which are multiplied by the rate. If in fact the total man-hours from H036B differs from the sum of man-hours (from several systems) for Support General, on-equipment repair, and non-modification TCTO, then the resulting cost estimates will be distorted.

Recommendation: ISI recommends that the calculation of average depot labor rate be based on division by the sum of the same man-hours for which costs are to be allocated, namely Support General, on-equipment repair, and non-modification TCTO.

Response: The OOV concurs. The suspense date for a DAR requesting this change is 31 July 1984.

10. Depot MDS "Other" Cost Rates

Criticism: Depot costs are categorized as labor, material, Support General, and "other." "Other" costs are allocated through development of an average "other" cost per maintenance man-hour. The man-hours are developed and applied exactly the same way as for labor rates (item 9 above), and the same criticism applies.

Recommendation: ISI recommends that the calculation of average depot "other" cost rates be based on division by the sum of the same man-hours for which costs are to be allocated, namely Support General, on-equipment repair, and non-modification TCTO.

Response: The OOV concurs. The suspense date for a DAR requesting this change is 31 July 1984.

11. Depot MDS Material Rates

Criticism: Depot direct material costs are based on material rates which are developed and applied in exactly the same way as labor rates (item 9 above), and the same criticism applies.

Recommendation: ISI recommends that the calculation of depot average material rate be based on division by the total of man-hours used to allocate material costs.

Response: The OOV concurs. The suspense date for a DAR requesting this change is 31 July 1984.

12. Depot Support General Other Costs

Criticism: The current algorithm for depot Support General costs considers direct labor only. "Other" costs, such as overhead and G&A, are usually allocated in proportion to labor hours, but are currently omitted.

Recommendation: ISI recommends that the depot MDS "other" cost rate be added to the labor rate, to provide a total cost rate to be applied to depot Support General man-hours.

Response: The OOV concurs. The suspense date for a DAR requesting this change is 31 July 1984.

13. Base Supply Management Overhead

Criticism: The Office of VAMOSC recognized that the existing method for calculating base supply management overhead was questionable. One feature of the method uses survey values of supply transactions per maintenance action. ISI found the survey methods

unverifiable, and the results not credible. Moreover, we found the methodology needlessly complex.

Recommendation: The D002A system currently provides the CSCS with a count of selected supply transactions. (Reference material indicates that the count is not the one desired by the CSCS.) It is recommended that the selection criteria be changed, so that two counts may be supplied: a count of transactions for aircraft and a count of total base supply transactions. The ratio of these counts provides an estimate of the proportion of supply management overhead costs attributable to aircraft. This fraction should be multiplied by the total base supply management overhead cost, yielding an estimate of the aircraft supply management overhead cost. This cost should be allocated to individual aircraft Work Unit Codes in proportion to the base maintenance direct labor man-hours spent on repair of these items.

Response: The OOV concurs. Implementation will be deferred because the D002A system is deferring implementation of DARs until that system has effected transition to the Phase IV computer system.

14. Shipping Costs

Criticism: Information Spectrum determined that the shipping cost calculations used in the CSCS are unquestionably an attempt to apply methods defined by AFLCP 173-10, AFLC Cost and Planning Factors. That methodology appears satisfactory, but several significant errors were made in documenting its application to the CSCS. These errors invalidate the calculated shipping costs.

Moreover, the CSCS calculations omit packaging costs, which are more significant than the transportation part of shipping costs.

Recommendation: We recommend that the shipping cost calculation of AFLCP 173-10 be followed exactly, including packaging costs.

Response: The OOV concurs. The suspense date for a DAR requesting this change is 31 August 1984.

15. Engine Shipments

Criticism: The current CSCS algorithm counts receipts of engines by depots for major overhaul. Each such report generates a two-way shipping cost between base and depot. Shipments between base and depot for reasons other than major overhaul are possible, but are not counted by the algorithm. Also, a significant amount of shipment of engines is between bases and "Queen Bee" (regional intermediate level engine repair) facilities. Such shipments are not counted by the algorithm.

Recommendation: ISI recommends that all reports of engine receipts by depots be used to generate two-way costs of shipping between base and depot. Reports of receipts of engines shipped from one base to another can be identified through the D042 data system. Reports of receipts of serviceable engines should be associated with the receiving base. Other reports should be associated with the shipping base. These reports should be used to generate one-way shipment costs.

Response: The OOV concurs. The suspense date for DARs supporting this change is 28 September 1984.

16. Engine Shipping Costs

Criticism: The CSCS converts counts of engine shipments to depots using the same average shipping costs per pound as for any other shipped material. Air Force engine management personnel have indicated that engine shipment procedures have unique features which cause the shipping costs to differ significantly from those generated by this approach. Each engine (identified by TMS) tends to have its own shipping characteristics.

Recommendation: The Office of VAMOSC should support an investigation into actual engine shipping costs. The investigation should develop, for each engine or module, average shipping costs to depot for CONUS and for overseas bases. For engines or modules maintained at Queen Bee facilities, average base to Queen Bee shipping costs should also be developed, both for CONUS and overseas bases. The average labor cost of preparing engines for shipment should also be determined.

The CSCS should store the resulting data in a table, and use it for estimating engine shipping costs. The table should be updated annually by application of inflation factors, and revised periodically by reiterated study efforts.

Response: The OOV concurs. Contact with transportation personnel at OC-ALC and SA-ALC has been initiated.

17. Data Processing for Depot Material Management Overhead Costs

Criticism: In the System Specification, ISI found several anomalies in the descriptions of the applicable data processing procedures. As a result, there is inadequate confidence that the CSCS output reports and magnetic tapes incorporate material management overhead cost elements as desired.

Recommendation: The OOV should confer with the CSCS programing activity to clearly establish the contributions of depot material management overhead cost elements to CSCS outputs, and to correct any deficiencies.

Response: The OOV concurs. The DAR requesting investigation into the actual calculation of MMOH costs will be submitted by 28 Sep 84.

18. Depot Material Management Overhead Factor

Criticism: The material management overhead factor used by the CSCS was developed for other purposes. It has not yet been possible to identify the organization which developed the factor, to determine the procedures used to develop it, or to verify its suitability for CSCS application.

Recommendation: ISI recommends that the OOV make a vigorous effort to identify the organization which developed the factor. Through it, either the suitability of the factor should be established, or a more suitable factor should be developed. In either event, supporting documentation should be provided.

Response: The OOV concurs. The CSCS OPR will contact those individuals who develop the MMOH rates found in AFR 26-1 and solicit their help in determining the applicability of those rates to CSCS. In addition, procedures will be set up to ensure that VAMOSC personnel are alerted to any future updates of the rates.

APPENDIX B

SURVEY ANALYSIS

As indicated in the text, 141 survey questionnaires were sent out. Thirty-three responses were received. Of these, 9 were essentially "no comment" responses.

ISI examined the remaining 24 responses, and tabulated answers to each question. In some cases we judged that an answer listed under one question belonged under another.

Figure B-1 tabulates the responses. Counts of the form Y/N tabulate YES/NO responses. For questions calling for a written response, the number of responses was counted. Only question 11 was answered on all 24 questionnaires.

The Office of VAMOSC has stated that there are 56 regularly scheduled recipients of CSCS products. There were 15 responses to question 3; we assume that these correspond to regular users. While some of the responses to the survey seemed perfunctory, many showed a sincere interest in the CSCS. Information Spectrum believes and recommends that regular users of the CSCS should be surveyed periodically. The questionnaire used was an experimental model, and consideration of the responses suggests areas where it could be improved. Also, the Office of VAMOSC should allocate resources to review of responses, contact with responders to clarify their answers, and procedures for reacting to responses.

PLEASE COMPLETE THIS QUESTIONNAIRE
FOLD, STAPLE AND MAIL TO THE ADDRESS
ON THE REVERSE BY 1 MAY 1984

		Response Counts
1.	Are you familiar with the CSCS Users Manual. Circle one (Y) (N)	19/4
	a. If yes, does it provide an adequate description of the CSCS data available? Circle one (Y) (N)	17/2
2.	If not familiar with CSCS data products, what needs do you have for historical operating and support (O&S) costs at the aircraft component (WUC) level? _____	7
3.	List reports/data you currently receive from the CSCS. Identify data elements that are of particular interest to you by their titles on the report. _____	15
4.	Do the reports you currently receive provide all the information you require? Circle one. (Y) (N)	7/8
5.	Indicate information you would like to see from CSCS that is <u>not included</u> in current reports. _____	9
6.	Do you consider the CSCS data to be useful? Circle one. (Y) (N)	18/2
7.	Is the format of the current output reports satisfactory. Circle one. (Y) (N)	17/3
	a. Is the media of the current output reports (microfiche, tape) satisfactory? Circle one. (Y) (N)	19/3
8.	How in your opinion can the CSCS output reports be improved? _____	10
9.	Do you have a continuing/regular need for CSCS data. Circle one. (Y) (N)	18/3
10.	Is the meaning of the information on CSCS reports clear and understood? Circle one. (Y) (N)	15/5
	a. Explain if NO. _____	5

Figure B-1. Questionnaire Response Counts

11. In your opinion, would a training package in the derivation/definition of CSCS data be useful? Circle one (Y) (N) 21/3

12. Are the CSCS quarterly output reports timely enough for your purposes? Circle one. (Y) (N) 20/1

13. Indicate the functional areas in which you have an interest in aircraft component costs.

18( )	Logistics	15( )	Cost Estimating
4( )	Budget Preparation	4( )	Procurement (Acquisition)
4( )	Planning and Programming	2( )	Other (Specify)

14. What do you/have you used(d) the CSCS data for? _____ 20

_____

15. Provide other comments as desired. _____ 14

_____

_____

(PLEASE PROVIDE RETURN ADDRESS ON REVERSE)

Figure B-1 (Continued)

Responses were few enough, and varied enough, so that statistical treatment is not warranted. The individual responses to questions 5, 8, and 15 deserve study of OOV personnel. In some cases users need an explanation. In others, suggestions should be considered for some future modification of the CSCS.

Information Spectrum has noted the following from its review of the responses:

(1) Training Packages

Question 11 shows a strong desire for a training package in the derivation/definition of CSCS data. It is interesting to note the following by comparing answers to questions 1a, 10, and 11: Of the 22 who desire a training package, 13 said the meaning of information on the reports is clear and understood, 16 said the User's Manual provides an adequate description, and 9 of these said both. We interpret these answers to mean that many users think they understand the outputs, but are not sure. Several users raised questions or made comments about CSCS outputs which indicated to us that they are less clear to the careful analyst than to the casual user. This is borne out by ISI's own experience. Even members of the OOV staff have expressed uncertainty about how some outputs are calculated.

Information Spectrum recommends the development of a training package. It should include a much more careful description of the algorithms and of the associated data processing. It should identify the meaning of each element of each output report. Whenever possible, these meanings should be expressed in terms of calculation procedures.

The training package should also include a set of representative analyses based on CSCS outputs.

(2) Output Quality

Most of the respondents consider the outputs useful, timely, and satisfactory in format and medium. A few recognized problems associated with the state of development of the system, e.g., no engine data, meaningless zero outputs,[1] data missing from the NSN/WUC Cross-Reference Dictionary. Several expressed skepticism about the current accuracy of the outputs.

(3) User Interest

While it may be argued that only the most interested users bothered to respond, ISI felt that the penetrating questions and comments on many questionnaires indicated a sincere interest and an impressive depth of understanding on the part of many responders.

[1] It appears that the CSCS programs treat some missing data as zeros, which is ill advised.

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This study is the twenty-first and last of a set of reports documenting the findings of a study conducted by Information Spectrum, Inc (ISI) for the Office of VAMOSC, Air Force Logistics Command under contract F33600-82-C-0543. This study constitutes an overall assessment of the data sources and processes used within the Component Support Cost System (CSCS) subsystem of VAMOSC, the Air Force Visibility and Management of Operating and Support Cost system. CSCS deals with subsystems and components

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20. for aircraft.

This report summarizes the activities of this research project. It complies the recommendations which arose out of the analyses of the 30 individual algorithms. Several recommendations have been included which relate to CSCS as a whole, rather then to any particular algorithm. It also provides an analysis of a survey of CSCS users.

This volume presents ISIs conclusions and recommendations, and the comments of the Office of VAMOSC.

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